

each, determined from anticipated usage of the ladder, shall also be included in determining the capabilities of fixed ladders. Each step or rung shall be capable of supporting at least a single concentrated load of 250 pounds (114 kg) applied in the middle of the step or rung.

(7) Ladder rungs and steps shall be parallel, level, and uniformly spaced when the ladder is in position for use.

(8) Ladder rungs and steps shall be spaced not less than six inches (15 cm) apart, nor more than 12 inches (31 cm) apart as measured along the ladder siderails. *Exception to paragraph (c)(8) of this section:* End frames of scaffolds and ladders in elevator shafts shall have rungs and steps spaced not less than six inches (15 cm) apart, nor more than 16½ inches (41 cm) apart, as measured along the ladder siderails.

(9) Ladder rungs and steps shall have a minimum clear width of 16 inches (41 cm) for individual-rung and fixed ladders, 12 inches (30 cm) for portable metal ladders and portable reinforced plastic ladders, and 11½ inches (29 cm) for portable wood ladders, as measured between the ladder siderails.

Exception to paragraph (c)(9) of this section: Narrow rungs, which are not designed to be stepped on, on the tapered ends of window washer ladders, fruit pickers' ladders, and similar ladders are exempt from the minimum rung width requirement.

(10) Wood ladders shall not be coated with any opaque covering, except for identification or warning labels which may be placed on one face only of a side rail.

(11) Metal ladders shall be protected against corrosion.

(12) The minimum toe clearance between the center line of ladder rungs and steps and any obstructions behind the ladder shall be seven inches (18 cm).

Exception to paragraph (c)(12) of this section: Toe clearances of no less than four and one-half inches (11.4 cm) are acceptable when a specific work operation renders a seven inch (17.8 cm) clearance infeasible.

(13) The minimum perpendicular clearance between the center line of fixed ladder rungs and steps and any obstruction on the climbing side of the ladder shall be 30 inches (76 cm).

Exception to paragraph (c)(13) of this section: When unavoidable obstructions are encountered, the minimum perpendicular clearance between the centerline of fixed ladder rungs and steps and the obstruction on the climbing side of the ladder may be reduced to 24 inches (61 cm) provided that a deflection device is installed to guide employees around the obstruction.

(14) Fixed ladders shall be equipped with personal fall protection systems in accordance with subpart I of this Part, or with cages or wells, wherever the length of any climb on any fixed ladder exceeds 24 feet (7.3 m), or wherever the top of the ladder is at a distance greater than 24 feet (7.3 m) above lower levels.

(15) Cages and wells provided for fixed ladders shall be designed to permit easy access to or egress from the ladder which they enclose. The cages and wells shall be continuous throughout the length of the fixed

ladder except for access, egress and other transfer points. Cages and wells shall be designed and constructed to contain employees in the event of a fall, and to direct them to a lower landing.

(16) The length of continuous climb for any fixed ladder equipped only with a cage or well shall not exceed 50 feet (15.2 m). When ladder safety devices are also used with cages or wells, the length of continuous climb may exceed 50 feet (15.2 m).

(17) Fixed ladders with continuous lengths of climb greater than 150 feet (45.7 m) shall be provided with rest platforms at least every 150 feet (45.7 m). The rest platforms shall provide a horizontal surface of at least 18 inches by 24 inches (46 cm by 61 cm) and have at least the same strength as required for the fixed ladder.

(18) Except where portable ladders are used to access fixed ladders, ladders shall be offset with a landing platform between each ladder when two or more separate ladders are used to reach a work area. Landing platforms shall provide a horizontal surface of at least 24 inches by 30 inches (61 cm by 76 cm) and have at least the same strength as the ladders.

(19) Ladder surfaces shall be free of puncture or laceration hazards.

(20) Fixed individual rung ladders shall be constructed to prevent the employee's feet from sliding off the end.

(21) The distance from the centerline of fixed ladder grab bars to the nearest permanent object in back of the grab bars shall be no less than four inches (10 cm).

(22) A ladder that might contact uninsulated energized electrical equipment shall have nonconductive siderails.

(23) Ladders having a pitch in excess of 90 degrees from the horizontal shall not be permitted, except for fixed ladders used in conical sections of manholes.

(24) The step-across distance from the centerline of the steps or rungs of a fixed ladder to the nearest edge of the structure, building, or equipment accessed shall not exceed 12 inches (30 cm).

(25) Ladders and ladder sections, unless so designed, shall not be tied or fastened together to provide longer length. Ladders and ladder sections shall not have their length increased by other means unless specifically designed for the means employed.

(26) A metal spreader or locking device shall be provided on each stepladder or combination ladder when used in the stepladder mode to hold the front and back sections securely in an open position.

§ 1910.24 Step bolts and manhole steps.

(a) *Scope and application.* This section covers step bolts and manhole steps used on structures such as, but not limited to, towers, stacks, conical manhole sections, and vaults. This section does not apply to individual rung ladders.

(b) *General requirements.* (1) Step bolts and manhole steps shall be continuous and spaced uniformly, not less than six inches (15 cm) nor more than 18 inches (46 cm) apart.

(2) The minimum clear step width of step bolts shall be four and one-half inches (14.4 cm). The minimum clear step width of manhole steps shall be 10 inches (25.4 cm).

(3) The minimum toe clearance for manhole steps shall be four inches (11.1 cm) from the point of embedment on the wall to the outside face of the step. The toe clearance in the center of the manhole step shall be a minimum of four and one-half inches (11.4 cm) measured to the outside face of the step.

(4) The minimum toe clearance for step bolts shall be seven inches (17.8 cm). Where obstructions cannot be avoided, toe clearances may be reduced to four and one-half inches (11.4 cm).

(5) Step bolts and manhole steps shall be designed to prevent the employee's foot from slipping or sliding off the end of the step bolt or manhole step.

(6) All manhole steps and step bolts installed after (*insert date 60 days after the effective date of the final rule in the Federal Register*) and used in corrosive environments, shall be constructed of, or coated with, a material that will retard corrosion of the step or bolt.

(7) All manhole steps installed on or after (*insert date 60 days after the effective date of the final rule in the Federal Register*) shall be provided with slip-resistant surfaces such as, but not limited to, corrugated, knurled, or dimpled surfaces.

(c) *Design, construction, maintenance, and inspection.* (1) *Step bolt design.* Each step bolt shall be capable of withstanding, without failure, at least four times the intended load to be applied to the bolt.

(2) Manhole steps installed before (*insert date 60 days after the effective date of the final rule in the Federal Register*) shall be capable of supporting their maximum intended load.

(3) *Design of manhole steps installed after (insert date 60 days after the effective date of the final rule in the Federal Register).* The employer shall ensure that manhole steps installed on or after (*insert date 60 days after the effective date of the final rule in the Federal Register*) shall meet the following requirements:

(i) The manhole steps shall be capable of withstanding and remaining solidly secured after being subjected to a separate application of a horizontal pull out load of 400 pounds (1780 N), and a vertical load of 800 pounds (3650 N).

(ii) The manhole steps shall be capable of sustaining the vertical test load without developing a permanent set greater than one-half inch (12.7 mm).

(iii) The loads shall be applied over a width of three and one-half inches (8.9 cm) centered on the step, and applied at a uniform rate until the required load is reached.

(iv) No cracking or fracture of the step nor spalling of the concrete shall be visible.

(4) *Maintenance and inspection.* Step bolts and manhole steps shall be maintained in a safe condition and visually inspected prior to each use.

(5) *Component replacement.* Step bolts which are bent greater than 15 degrees below the horizontal shall be removed and replaced with bolts that meet the requirements of this section. Manhole steps that are bent to such an extent as to reduce the step's projection from the wall to less than four inches (11.1 cm) shall be removed and replaced with a